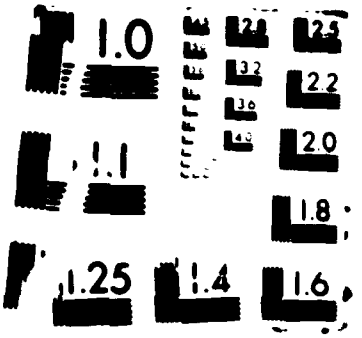
AD-A182 005 INTEGRATED INFORMATION SUPPORT SYSTEM (IISS) VOLUME 5 1/1
COMMON DATA MODEL S..(U) GENERAL ELECTRIC CO
SCHENECTADY NY PRODUCTION RESOURCES CONSU..
UNCLASSIFIED D B THOMPSON ET AL. 01 NOV 85 PS-620141251 F/G 12/5 NL

END


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5

AFWAL-TR-86-4006
Volume V
Part 16

INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume V - Common Data Model Subsystem
Part 16 - NDML Precompiler Select Internal Schema Access Path Product Specification

General Electric Company
Production Resources Consulting
One River Road
Schenectady, New York 12345

Final Report for Period 22 September 1980 - 31 July 1985

November 1985

MATERIALS LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AFB, OH 45433-6533

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

AI81 005

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S) AFWAL-TR-86-4006 Vol V, Part 16
6a NAME OF PERFORMING ORGANIZATION General Electric Company Production Resources Consulting 6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION AFWAL/MLTC
6c ADDRESS (City, State and ZIP Code) 1 River Road Schenectady, NY 12345	7b ADDRESS (City, State and ZIP Code) WPAFB, OH 45433-6533
8a NAME OF FUNDING/SPONSORING ORGANIZATION Materials Laboratory Air Force Systems Command, USAF 8b OFFICE SYMBOL (If applicable) AFWAL/MLTC	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-80-C-5155
8c ADDRESS (City, State and ZIP Code) Wright-Patterson AFB, Ohio 45433	10 SOURCE OF FUNDING NOS PROGRAM ELEMENT NO. 78011F; PROJECT NO. 7500; TASK NO. 62; WORK UNIT NO. 01
11 TITLE (Include Security Classification) (See Reverse)	
12 PERSONAL AUTHOR(S) Thompson, D. B. and Apicella, M. L.	
13a TYPE OF REPORT Final Technical Report 13b TIME COVERED 82 Sept 1980 - 31 July 1985 14 DATE OF REPORT (Yr., Mo., Day) 1985 November 15 PAGE COUNT 66	
16 SUPPLEMENTARY NOTATION ICAM Project Priority 6201 The computer software contained herein are theoretical and/or references that in no way reflect Air Force-owned or -developed computer software.	
17 COSATI CODES FIELD 1308; GROUP 0905; SUB GR	18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This document is the product specification establishing the design implementation of the IISS Configuration Item PRE6 which will determine a navigational access path through a network database to satisfy a neutral data request.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21 ABSTRACT SECURITY CLASSIFICATION Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL David L. Judson	22b TELEPHONE NUMBER (Include Area Code) 513-255-6976 22c OFFICE SYMBOL AFWAL/MLTC

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

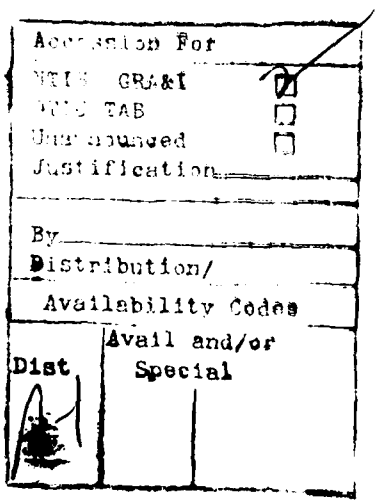
Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

11. Title

Integrated Information Support System (IISS)
Vol V - Common Data Model Subsystem
Part 16 - NDML Precompiler Select Internal Schema
Access Path Product Specification

A S D 86 1468
17 Jul 1986



PREFACE

This product specification covers the work performed under Air Force Contract F33615-80-C-5155 (ICAM Project 6201). This contract is sponsored by the Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. It was administered under the technical direction of Mr. Gerald C. Shumaker, ICAM Program Manager, Manufacturing Technology Division, through Project Manager, Mr. David Judson. The Prime Contractor was Production Resources Consulting of the General Electric Company, Schenectady, New York, under the direction of Mr. Alan Rubenstein. The General Electric Project Manager was Mr. Myron Hurlbut of Industrial Automation Systems Department, Albany, New York.

Certain work aimed at improving Test Bed Technology has been performed by other contracts with Project 6201 performing integrating functions. This work consisted of enhancements to Test Bed software and establishment and operation of Test Bed hardware and communications for developers and other users. Documentation relating to the Test Bed from all of these contractors and projects have been integrated under Project 6201 for publication and treatment as an integrated set of documents. The particular contributors to each document are noted on the Report Documentation Page (DD1473). A listing and description of the entire project documentation system and how they are related is contained in document FTR620100001, Project Overview.

The subcontractors and their contributing activities were as follows:

TASK 4.2

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Reviewer
D. Appleton Company (DACOM)	Responsible for IDEF support, state-of-the-art literature search
General Dynamics/ Ft. Worth	Responsible for factory view function and information models

Subcontractors	Role
Illinois Institute of Technology	Responsible for factory view function research (IITRI) and information models of small and medium-size business
North American Rockwell	Reviewer
Northrop Corporation	Responsible for factory view function and information models
Pritsker and Associates	Responsible for IDEF2 support
SofTech	Responsible for IDEF0 support

TASKS 4.3 - 4.9 (TEST BED)

Subcontractors	Role
Boeing Military Aircraft Company (BMAC)	Responsible for consultation on applications of the technology and on IBM computer technology.
Computer Technology Associates (CTA)	Assisted in the areas of communications systems, system design and integration methodology, and design of the Network Transaction Manager.
Control Data Corporation (CDC)	Responsible for the Common Data Model (CDM) implementation and part of the CDM design (shared with DACOM).
D. Appleton Company (DACOM)	Responsible for the overall CDM Subsystem design integration and test plan, as well as part of the design of the CDM (shared with CDC). DACOM also developed the Integration Methodology and did the schema mappings for the Application Subsystems.

Subcontractors	Role
Digital Equipment Corporation (DEC)	Consulting and support of the performance testing and on DEC software and computer systems operation.
McDonnell Douglas Automation Company (McAuto)	Responsible for the support and enhancements to the Network Transaction Manager Subsystem during 1984/1985 period.
On-Line Software International (OSI)	Responsible for programming the Communications Subsystem on the IBM and for consulting on the IBM.
Rath and Strong Systems Products (RSSP) (In 1985 became McCormack & Dodge)	Responsible for assistance in the implementation and use of the MRP II package (PIOS) that they supplied.
SofTech, Inc.	Responsible for the design and implementation of the Network Transaction Manager (NTM) in 1981/1984 period.
Software Performance Engineering (SPE)	Responsible for directing the work on performance evaluation and analysis.
Structural Dynamics Research Corporation (SDRC)	Responsible for the User Interface and Virtual Terminal Interface Subsystems.

Other prime contractors under other projects who have contributed to Test Bed Technology, their contributing activities and responsible projects are as follows:

Contractors	ICAM Project	Contributing Activities
Boeing Military Aircraft Company (BMAC)	1701, 2201, 2202	Enhancements for IBM node use. Technology Transfer to Integrated Sheet Metal Center (ISMC)

Contractors	ICAM Project	Contributing Activities
Control Data Corporation (CDC)	1502, 1701	IISS enhancements to Common Data Model Processor (CDMP)
D. Appleton Company (DACOM)	1502	IISS enhancements to Integration Methodology
General Electric	1502	Operation of the Test Bed and communications equipment.
Hughes Aircraft Company (HAC)	1701	Test Bed enhancements
Structural Dynamics Research Corporation (SDRC)	1502, 1701, 1703	IISS enhancements to User Interface/Virtual Terminal Interface (UI/VTI)
Systran	1502	Test Bed enhancements. Operation of Test Bed.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

SECTION 1

SCOPE

1.1 Identification

This specification establishes the design of Function PRE6, "Select IS Access Path", one of the major functions of the Configuration Item "Precompiler" to be built and formally accepted by the ICAM Program Office. This CI constitutes one of the subsystems of the Common Data Model Processor (CDMP).

1.2 Functional Flow

The purpose of this Computer Program Configuration Item (CPCI) is to select an internal schema access path through a CODASYL database to satisfy an NDML subtransaction request.

The following functions will be performed by the CPCI:

1. Determine if a calc key search of the database is possible.
2. Determine if an area sweep of the database is required.
3. Construct the optimal access path through the database in generic access path specification code terms using data from the internal schema tables.

SECTION 2

DOCUMENTS

2.1 Reference Documents

1. ICAM Documentation Standards: IDS15012000A, 28 December 1981.

2. D. Appleton Co., CDM Administrators Manual: UM620141000, March 1984.

3. D. Appleton Co., CDM1-IDEF, Model of the Common Data Model: CCS620141000, 15 May, 1985.

4. D. Appleton Co., Computer Program Development Specification (DS) for ICAM Integrated Support System (IISS) Configuration Item: NDML Precompiler: DS620141200, October 1984.

5. D. Appleton Co., Embedded NDML Programmer's Reference Manual: PRM620141200, March, 1985.

6. Softech, Inc., NTM Programmer's Guide: UM620140001, July, 1984.

7. Control Data Corp., Computer Program Development Specification (DS) for ICAM Integrated Support System (IISS) Configuration Item: NDDL Command Processor: DS620141100, June 1985

2.2 Terms and Abbreviations

Attribute Use Class: (AUC)

Conceptual Schema: (CS)

Common Data Model Processor: (CDMP)

Common Data Model: (CDM) Describes common data application process formats, form definitions, etc, of the IISS and includes conceptual schema, external, internal schemas, and schema transformation operators.

Data Field: (DF) An element of data in the external schema. It is by this name that an NDML programmer references data.

Database Management System: (DBMS)

Distributed Request Supervisor: (DRS) This IISS CDM subsystem configuration item controls the execution of distributed NDML queries and non distributed updates.

Domain: A logical definition of legal attribute class values.

Domain Constraint: Predicate that applies to a single domain.

External Schema: (ES)

Forms: Structured views which may be imposed on windows or other forms. A form is composed of fields where each field is a form, item, or window.

Forms Processor: (FP) A set of callable execution time routines available to an application program for form processing.

Internal Schema: (IS)

Integrated Information Support System: (IISS) A test computing environment used to investigate, demonstrate and test the concepts of information management and information integration in the context of Aerospace Manufacturing. The IISS addresses the problems of integration of data resident on heterogeneous databases supported by heterogeneous computers interconnected via a local Area Network.

Mapping: The correspondence of independent objects in two schemas: ES to CS or CS to IS.

Network Transaction Manager: (NTM) Performs the coordination, communication and housekeeping functions required to integrate the application processes and system services resident on the various hosts into a cohesive system.

Neutral Data Manipulation Language: (NDML) A language developed by the IISS project to provide uniform access to common data, regardless of database manager or distribution

criteria. It provides distributed retrieved and single node updates.

ORACLE: Relational DBMS based on the SQL (Structured Query Language, a product of ORACLE Corp, Menlo Park, CA). The CDM is an ORACLE database.

Parcel: A sequential file containing sections of source code of the input Application Program.

Request Processor: (RP) A COBOL program that will satisfy a retrieval or update NDML subtransaction against a particular Database Management System.

User Interface: (UI) Controls the user's terminal and interfaces with the rest of the system.

Virtual Terminal Interface: (VTI) Performs the interfacing between different terminals and the UI. This is done by defining a specific set of terminal features and protocols which must be supported by UI software which constitutes the Virtual Terminal Definition. Specific terminals are then mapped against the Virtual Terminal software by specific software modules written for each type of real terminal supported.

SECTION 3

REQUIREMENTS

3.1 Structural Description

The graphic portrayal of this CPCI is included in Section 3.10. This chart shows the hierarchical relationship of each module making up this CPCI.

This CPCI uses a lower level module to identify complete internal schema primary or secondary keys in the NDML request (CDPR7KY).

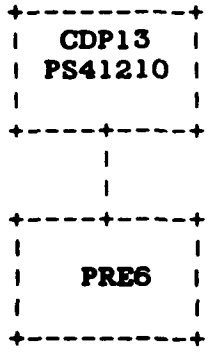
3.2 Functional Flow

This CPCI implemented the logic defined in the Development Specification for this CPCI. Details of inputs/outputs and relationships between modules are found in Section 3.10.

This CPCI has been designated to operate in a batch or interactive mode. It must operate in the system environment established for IISS; that is, the Network Transaction Manager. The ORACLE DBMS installed on a DEC VAX computer must be used.

3.3 Interfaces

The following diagram depicts the interface of PRE6 with other CPCI's in the system.



3.3.1 Inputs/Outputs

The following table depicts the inputs and outputs of this CPCI. A detailed description for each item can be found in the DS for this CPCI.

FUNCTION: PRE6

INPUT	OUTPUT
Database Identification Number	Access Path Specification
Current Subtransaction	Code Table
Internal Schema Action List	---
Internal Schema Qualify List	Record Key Table
Set Table	Access Path Data
ORACLE Logon Data Area	Information Table
Error File Name	Error status code

3.4 Program Interrupts

Not applicable to the CPCI.

3.5 Timing and Sequencing Description

This CPCI is activated for each CODASYL database subtransaction constructed by PRE5. The timing and sequence of the call to this CPCI is determined by the support routines CDP13.

3.6 Special Control Features

Not applicable to this CPCI.

3.7 Storage Allocation

3.7.1 Database Definition

The database used by this CPCI is the Common Data Model (CDM) database. The model is defined by the CDM1, the IDEF1 model of the CDM, Reference Document Number 3.

3.7.1.1 File Description

SECTION 3

REQUIREMENTS

3.1 Structural Description

The graphic portrayal of this CPCI is included in Section 3.10. This chart shows the hierarchical relationship of each module making up this CPCI.

This CPCI uses a lower level module to identify complete internal schema primary or secondary keys in the NDML request (CDPR7KY).

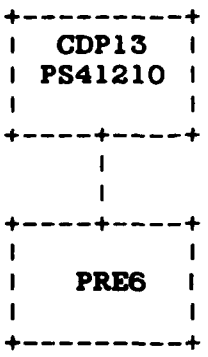
3.2 Functional Flow

This CPCI implemented the logic defined in the Development Specification for this CPCI. Details of inputs/outputs and relationships between modules are found in Section 3.10.

This CPCI has been designated to operate in a batch or interactive mode. It must operate in the system environment established for IISS; that is, the Network Transaction Manager. The ORACLE DBMS installed on a DEC VAX computer must be used.

3.3 Interfaces

The following diagram depicts the interface of PRE6 with other CPCI's in the system.



3.3.1 Inputs/Outputs

The following table depicts the inputs and outputs of this CPCI. A detailed description for each item can be found in the DS for this CPCI.

FUNCTION: PRE6

INPUT	OUTPUT
Database Identification Number	Access Path Specification
Current Subtransaction	Code Table
Internal Schema Action List	---
Internal Schema Qualify List	Record Key Table
Set Table	Access Path Data
ORACLE Logon Data Area	Information Table
Error File Name	Error status code

3.4 Program Interrupts

Not applicable to the CPCI.

3.5 Timing and Sequencing Description

This CPCI is activated for each CODASYL database subtransaction constructed by PRE5. The timing and sequence of the call to this CPCI is determined by the support routines CDP13.

3.6 Special Control Features

Not applicable to this CPCI.

3.7 Storage Allocation

3.7.1 Database Definition

The database used by this CPCI is the Common Data Model (CDM) database. The model is defined by the CDM1, the IDEF1 model of the CDM, Reference Document Number 3.

3.7.1.1 File Description

SECTION 3

REQUIREMENTS

3.1 Structural Description

The graphic portrayal of this CPCI is included in Section 3.10. This chart shows the hierarchical relationship of each module making up this CPCI.

This CPCI uses a lower level module to identify complete internal schema primary or secondary keys in the NDML request (CDPR7KY).

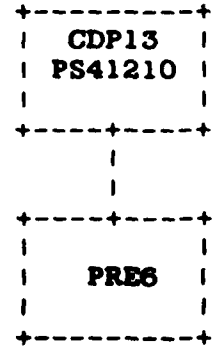
3.2 Functional Flow

This CPCI implemented the logic defined in the Development Specification for this CPCI. Details of inputs/outputs and relationships between modules are found in Section 3.10.

This CPCI has been designated to operate in a batch or interactive mode. It must operate in the system environment established for IISS; that is, the Network Transaction Manager. The ORACLE DBMS installed on a DEC VAX computer must be used.

3.3 Interfaces

The following diagram depicts the interface of PRE6 with other CPCI's in the system.



3.3.1 Inputs/Outputs

The following table depicts the inputs and outputs of this CPCI. A detailed description for each item can be found in the DS for this CPCI.

FUNCTION: PRE6

INPUT	OUTPUT
Database Identification Number	Access Path Specification
Current Subtransaction	Code Table
Internal Schema Action List	---
Internal Schema Qualify List	Record Key Table
Set Table	Access Path Data
ORACLE Logon Data Area	Information Table
Error File Name	Error status code

3.4 Program Interrupts

Not applicable to the CPCI.

3.5 Timing and Sequencing Description

This CPCI is activated for each CODASYL database subtransaction constructed by PRE5. The timing and sequence of the call to this CPCI is determined by the support routines CDP13.

3.6 Special Control Features

Not applicable to this CPCI.

3.7 Storage Allocation

3.7.1 Database Definition

The database used by this CPCI is the Common Data Model (CDM) database. The model is defined by the CDM1, the IDEF1 model of the CDM, Reference Document Number 3.

3.7.1.1 File Description

No permanent files have been defined for this CPCI. It may use temporary scratch files for such things as inputs and results.

3.7.1.2 Table Description

All tables used by this CPCI have been defined by the Development Specification for this CPCI.

3.7.1.3 Item Description

Not applicable to this CPCI.

3.8 Object Code Creation

The object code for this CPCI will be created by the system integration team using defined IISS Software Configuration Management Procedures. This CPCI will use the COBOL and FORTRAN language compilers. This CPCI will use the COBOL language compilers.

3.9 Adaptation Data

This CPCI has been coded using ANSI COBOL language. The intent was to provide a transportable system. Any system environment supporting this language, a virtual memory management schema, the COMM and NTM subsystems of IISS and the ORACLE Database Management System should be able to support this CPCI. Every possible attempt has been made to localize and identify any machine or environment dependent modules through the original design of the IISS and application of Configuration Management Procedures.

3.10 Detail Design Description

The following sections have been computer generated for this CPCI.

3.10.1 Main Program List

The following is a list of all "Main Programs" which are modules that are not called by any other module being documented here. These modules are either program entry points or, if they are hooked into another set of programs via subroutine calls, they are the points the external programs can call and therefore enter through. To differentiate between the two types of entry points, look at the individual Module Documentation (section 3.10.8) and look at Module Type for each of the Main Program modules listed. Note whether the routine is a Program, Subroutine, or Function. If it is a Program, it is truly a main program entry point. If not, then it is merely called by other programs not being documented here.

SELECT ACCESS PATH Main Program List

Module Name	Purpose
CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

3.10.2 Module List

The following is a list of all the modules being documented here along with their purpose. Each module has a unique name, no matter what language it was written in.

SELECT ACCESS PATH Module List

Module Name	Purpose
CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

3.10.3 External Routines List

The following is a list of all routines or functions not documented here that are called by modules that are documented here. The first caller, in alphabetical order, is listed as well. The specification in which any module is documented may be found in the Module Documentation Index (Document Number CM 620100001). See section 3.10.6 for a list of the modules that call each of these external routines.

SELECT ACCESS PATH External Routines List

Module Name	First User
ERRPRO	CDPR7KY
OBINDN	CDPRE7
OCLOSE	CDPR7KY
ODFINN	CDPRE7
OEXEC	CDPRE7
OFETCH	CDDBTP
OOPEN	CDPR7KY
OSQL3	CDDBTP
RPTERR	CDPRE7

3.10.4 Include File List

The following is a list of all include files called in by modules being documented here. Each include file has a unique name regardless of the language being used. The purpose of each include file is listed as well. A more complete description of each include file is given in section 3.10.9. The purpose listed is the one that is in the source code of the include file.

A purpose of "**** PURPOSE NOT FOUND BY STRIPPER ****" indicates that a purpose statement was not written into the include file itself. The most common reason for this is that the include file comes from system libraries that were not developed by the project, such as 'C' libraries that are provided with the 'C' compiler.

See section 3.10.6 for a set of lists which show all the modules which call in each of these include files.

SELECT ACCESS PATH Include File List

File Name	Purpose
APAT	ACCESS PATH TABLE
APGRP	SUBTRANSACTION GROUPING TABLE
APINFO	ACCESS PATH INFORMATION TABLE
APRK	TABLE OF RECORD KEYS FOR CODASYL ACCESS PATHS
CHKCDM	IISS CDMP CHECK STATUS CODES
ERRCDM	IISS ERROR STATUS CODES FOR CDMP MODULES
ERRPRO	PROCESS ERROR INCLUDE FILE
ISAL	INTERNAL SCHEMA ACTION LIST
ISQUAL	INTERNAL SCHEMA QUALIFY LIST
ORCLEDA	WS DEFINITION FOR THE ORACLE LOGIN AREA
SETTAB	LIST OF SETS OWNER-MEMBER RELATIONSHIPS

3.10.5 Where Include File Used List

The following lists each include file from 3.10.4 and all the modules documented in this specification which include them. The purpose of each module is listed as well.

SELECT ACCESS PATH Where-include-file-used List

Include File	Module Name	Module Purpose
APAT		
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
APGRP		
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
APINFO		
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
APRK		
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
CHKCDM		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ERRCDM		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.

SELECT ACCESS PATH Where-include-file-used List

Include File	Module Name	Module Purpose
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ERRPRO		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ISAL		
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ISQUAL		
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ORCLEDA		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

SELECT ACCESS PATH Where-include-file-used List

Include File	Module Name	Module Purpose

SETTAB

	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

3.10.6 Where External Routine Used List

The following lists each external function or routine listed in 3.10.3 and all the documented modules which call it. The purpose of each module is listed as well.

SELECT ACCESS PATH Where-external-routine-used List

System Module	Module Name	Module Purpose
ERRPRO		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
OBINDN		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
OCLOSE		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
ODFINN		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
OEXEC		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

SELECT ACCESS PATH Where-external-routine-used List

System Module	Module Name	Module Purpose
OFETCH		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
OOPEN		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
OSQL3		
	CDDBTP	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH
RPTERR		
	CDPR7KY	RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
	CDPRE7	SELECT INTERNAL SCHEMA ACCESS PATH

3.10.7 Main Program Parts List

The following lists each Main Program listed in 3.10.1 and all the modules which are called either by that module itself or by any of the documented modules which it calls. It is possible for a non-main module to be listed more that once if it is called by multiple modules. The called modules, in this case known as program parts, are marked as to whether they are documented here. If so, the phrase "well-defined module" appears by the module name, if not it is an "external "routine". The Purpose of the Main Program module is listed as well.

SELECT ACCESS PATH Main Program Parts List

Main Pgm Name	Module Name	Module Type
CDDBTP	Purpose--›	SEARCH FOR DB SPECIFIC ATTRIBUTES.
	ERRPRO	External routine
	OBINDN	External routine
	OCLOSE	External routine
	ODFINN	External routine
	OEXEC	External routine
	OFETCH	External routine
	OOPEN	External routine
	OSQL3	External routine

SELECT ACCESS PATH Main Program Parts List

Main Pgm Name	Module Name	Module Type
CDPRE7	Purpose--›	SELECT INTERNAL SCHEMA ACCESS PATH
	CDPR7KY	Well-defined module
	ERRPRO	External routine
	OBINDN	External routine
	OCLOSE	External routine
	ODFINN	External routine
	OEXEC	External routine
	OFETCH	External routine
	OOPEN	External routine
	OSQL3	External routine
	RPTERR	External routine

3.10.8 Module Documentation

The following documentation describes information which is specific to each individual module being documented in this specification as listed in section 3.10.2. It provides a compact way of getting information that would be otherwise buried within each module's source code.

The specific items in this module documentation have the following meanings:

NAME:	Name of program Module.
PURPOSE:	Purpose of Module as detailed in the source code.
LANGUAGE:	Programming language source code is written in. The choices are: VAX-11 FORTRAN C (I/S-1 Workbench 'C') VAX-11 COBOL
MODULE TYPE:	Whether a Program, Subroutine, or Function.
SOURCE FILE:	Name of Source File from file specification.
SOURCE FILE TYPE:	Source File Extension from file specification.
HOST:	Whether this is a host-dependent routine (VAX or IBM) or blank if host-independent.
SUBSYSTEM:	IISS sub-system this file resides in.
SUBDIRECTORY:	Sub-directory of that subsystem in which this file resides.
DOCUMENTATION GROUP:	Name of documentation group of which this source file is a member.

DESCRIPTION:	A description of the module as otained from the source code.
ARGUMENTS:	The arguments with which this routine is called if it is a Subroutine or a Function.
INCLUDE FILES:	A list of all the files that are included into this module as well as their purposes.
ROUTINES CALLED:	Subroutines or Functions, either documented or external, called by this module, if any.
CALLED DIRECTLY BY:	The documented routines which call this module, if any.
USED IN MAIN PROGRAM(S):	The documented Main Programs which contain this module in their parts list according to the list in section 3.10.7.

The Module Documentation is arranged alphabetically according to Module Name.

SELECT ACCESS PATH Module Documentation

NAME: CDDBTP
PURPOSE: SEARCH FOR DB SPECIFIC ATTRIBUTES.
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: CDDBTP
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41251

DESCRIPTION:

- CDDBTP WILL SUPPLY CDM INFORMATION
ABOUT A DATA BASE GIVEN THE DB_ID.
MOD FOR RELEASE 2.0 -
STANDARDIZE ERROR HANDLING AND
ADD SCHEMA NAMES AND DB PASSWORD. COMBIN
INTO ONE SQL STATEMENT WITH OUTER-JOINS

ARGUMENTS:

INPUT-DBID = DSPLY [99999]
ORACLE-LDA = RECRD
DBMS-NAME = DSPLY [X(30)]
HOST-ID = DSPLY [XXX]
DB-NAME = DSPLY [X(30)]
LIBRARY-NAME = DSPLY [X(30)]
SCHEMA-NAME = DSPLY [X(30)]
SUBSCHEMA-NAME = DSPLY [X(30)]
DB-LOCATION = DSPLY [X(30)]
DB-PASSWORD = DSPLY [X(30)]
RET-STATUS = DSPLY [X(5)]

INCLUDE FILES:

CMKCDM - IISS CDMP CHECK STATUS CODES
ERRCDM - IISS ERROR STATUS CODES FOR CDMP MODULES
ORCLEDA - WS DEFINITION FOR THE ORACLE LOGIN AREA
ERRPRO - PROCESS ERROR INCLUDE FILE

ROUTINES CALLED:

- OOPEN
- OSQL3
- ODFINN
- OBINDN
- OEXEC
- OFETCH
- OCLOSE
- ERRPRO

SELECT ACCESS PATH Module Documentation

NAME: CDPR7KY
PURPOSE: RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: CDPR7KY
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41251

DESCRIPTION:

SELECTS ALL THE DATA FIELDS FOR A GIVEN RTID, BUILDS THE COMPOSITE KEYS, SEARCHES THE APPROPRIATE IS LIST FOR A COMPLETE KEY, THEN RETURNS INFO ON COMPLETE KEYS IN THE RECORD-KEY TABLE.

-

CDM RULES and ASSUMPTIONS:
1. If a group data item is flagged as a primary key, then its component data fields must flagged as non-key or secondary keys.

2. A key group data item may be redefined, but the redefinition must also be flagged as key.

3. A data field which is a component of a key may not be redefined.

If CDM has --dfid	and key code--	IS/ISQ has --dfid--	then RK-TABLE has --dfid	key code
02 D	"P"	D	D only	"P"
03 E	"S"	E		
03 F		F		

```
02 BB          "P"          DD          DD          "P"
03 DD                   EE          EE          "P"
03 EE


02 ABC         "P"          DE          DE          "S"
03 AB       "S"
03 BC
02 DEF redefines ABC
03 DE       "S"
03 EF
```

ARGUMENTS:

```
DBID = DSPLY [9(5)]
SUB-ID = DSPLY [9(3)]
IS-ACTION-LIST = RECRD
IS-QUALIFY-LIST = RECRD
GROUP-TABLE = RECRD
ORACLE-LDA = RECRD
ERROR-FILE = DSPLY [X(30)]
RECORD-KEY-TABLE = RECRD
QCS-CDMP-CHECK-STATUS = DSPLY [X(5)]
```

INCLUDE FILES:

```
ERRCDM      - IISS ERROR STATUS CODES FOR CDMP MODULES
ISAL        - INTERNAL SCHEMA ACTION LIST
ISQUAL      - INTERNAL SCHEMA QUALIFY LIST
APGRP       - SUBTRANSACTION GROUPING TABLE
ORCLEDA     - WS DEFINITION FOR THE ORACLE LOGIN AREA
APRK        - TABLE OF RECORD KEYS FOR CODASYL ACCESS PATHS
CHKCDM      - IISS CDMP CHECK STATUS CODES
ERRPRO      - PROCESS ERROR INCLUDE FILE
```

ROUTINES CALLED:

```
OOPEN
OCLOSE
OFETCH
OSQL3
ODFINN
OBINDN
```

OEXEC
RPTERR
ERRPRO

CALLED DIRECTLY BY:

CDPRE7 - SELECT INTERNAL SCHEMA ACCESS PATH

USED IN MAIN PROGRAM(S):

CDPRE7 - SELECT INTERNAL SCHEMA ACCESS PATH

SELECT ACCESS PATH Module Documentation

NAME: CDPRE7
PURPOSE: SELECT INTERNAL SCHEMA ACCESS PATH
LANGUAGE: VAX-11 COBOL
MODULE TYPE: SUBROUTINE
SOURCE FILE: CDPRE7
SOURCE FILE TYPE: .COB
HOST:
SUBSYSTEM: CDM
SUBDIRECTORY:
DOCUMENTATION GROUP: PS41251

DESCRIPTION:

- SELECT AN ACCESS PATH THRU A CODYSYL DATABASE TO SATISFY AN NDML QUERY

- All entries in the IS-ACTION are processed. Only type 2 and type 3 entries from the IS-QUALIFY are processed. Not all entries in the set table necessarily map to the IS and ISQ tables.

ARGUMENTS:

DBID = DSPLY [9(5)]
SUB-ID = DSPLY [9(3)]
IS-ACTION-LIST = RECRD
IS-QUALIFY-LIST = RECRD
SET-TABLE = RECRD
ORACLE-LDA = RECRD
ERROR-FILE = DSPLY [X(30)]
ACCESS-PATHS = RECRD
RECORD-KEY-TABLE = RECRD
AP-INFO-TABLE = RECRD
QCS-CDMP-CHECK-STATUS = DSPLY [X(5)]

INCLUDE FILES:

APGRP - SUBTRANSACTION GROUPING TABLE
ERRCDM - IISS ERROR STATUS CODES FOR CDMP MODULES

ISAL	- INTERNAL SCHEMA ACTION LIST
ISQUAL	- INTERNAL SCHEMA QUALIFY LIST
SETTAB	- LIST OF SETS OWNER-MEMBER RELATIONSHIPS
ORCLEDA	- WS DEFINITION FOR THE ORACLE LOGIN AREA
CHKCDM	- IISS CDMP CHECK STATUS CODES
APAT	- ACCESS PATH TABLE
APINFO	- ACCESS PATH INFORMATION TABLE
APRK	- TABLE OF RECORD KEYS FOR CODASYL ACCESS PATHS
ERRPRO	- PROCESS ERROR INCLUDE FILE

ROUTINES CALLED:

CDPR7KY	- RETURNS COMPLETE KEYS FOR EACH RECORD IN THE SUBTRANSACTION
RPTERR	
OCLOSE	
OOPEN	
OFETCH	
OSQL3	
ODFINN	
OBINDN	
OEXEC	
ERRPRO	

3.10.9 Include File Descriptions

The following list contains a purpose and description of each include file listed in 3.10.4 as specified in the source code. The language it is written in is also given.

SELECT ACCESS PATH Include File Description

FILE NAME: APAT
PURPOSE: ACCESS PATH TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS THE ACCESS PATH FOR ONE SUBTRANSACTION
FOR A NDML REQUEST.

SELECT ACCESS PATH Include File Description

FILE NAME: APGRP
PURPOSE: SUBTRANSACTION GROUPING TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

Definition of the GROUP-TABLE local to the

SELECT ACCESS PATH Include File Description

FILE NAME: APINFO
PURPOSE: ACCESS PATH INFORMATION TABLE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THIS IS A COLLECTION OF INFORMATION STORED IN A
NUMBER OF VARIOUS TABLES USED BY THE ACCESS PATH TABLE
AND THE GENERIC CODASYL TABLE. SEE CDMP SPEC, PRE6

APINFO.INC

SELECT ACCESS PATH Include File Description

FILE NAME: APRK
PURPOSE: TABLE OF RECORD KEYS FOR CODASYL ACCESS PATHS
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS INFORMATION FOR THE KEYS OF
RECORDS CONTAINED IN THE CURRENT ACCESS
PATH

SELECT ACCESS PATH Include File Description

FILE NAME: CHKCDM
PURPOSE: IISS CDMP CHECK STATUS CODES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS ALL STATUS CODES FOR THE
CDMP MODULES

SELECT ACCESS PATH Include File Description

FILE NAME: ERRCDM
PURPOSE: IISS ERROR STATUS CODES FOR CDMP MODULES
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

```
------------
   CONTAINS ALL ERROR CODES USED BY CDMP       *
   MODULES FOR ERROR HANDLING                  *
```

SELECT ACCESS PATH Include File Description

FILE NAME: ERRPRO
PURPOSE: PROCESS ERROR INCLUDE FILE
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

SELECT ACCESS PATH Include File Description

FILE NAME: ISAL
PURPOSE: INTERNAL SCHEMA ACTION LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS INTERNAL SCHEMA INFORMATION ABOUT AN NDML REQUEST

THE INTERNAL SCHEMA ACTION LIST

SELECT ACCESS PATH Include File Description

FILE NAME: ISQUAL
PURPOSE: INTERNAL SCHEMA QUALIFY LIST
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

CONTAINS INTERNAL SCHEMA INFORMATION FOR AN NDML QULIFICATION

THE INTERNAL SCHEMA QUALIFY LIST

SELECT ACCESS PATH Include File Description

FILE NAME: ORCLEDA
PURPOSE: WS DEFINITION FOR THE ORACLE LOGIN AREA
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

THE ORACLE LOGON DATA AREA

SELECT ACCESS PATH Include File Description

FILE NAME: SETTAB
PURPOSE: LIST OF SETS OWNER-MEMBER RELATIONSHIPS
LANGUAGE: VAX-11 COBOL

DESCRIPTION:

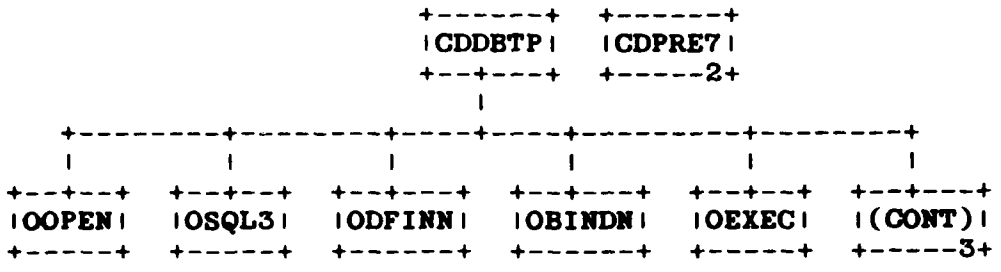
SET TABLE TO KEEP TRACK OF CODASYL NDML REQUESTS
IN TERMS OF OWNER AND MEMBER RELATIONSHIPS

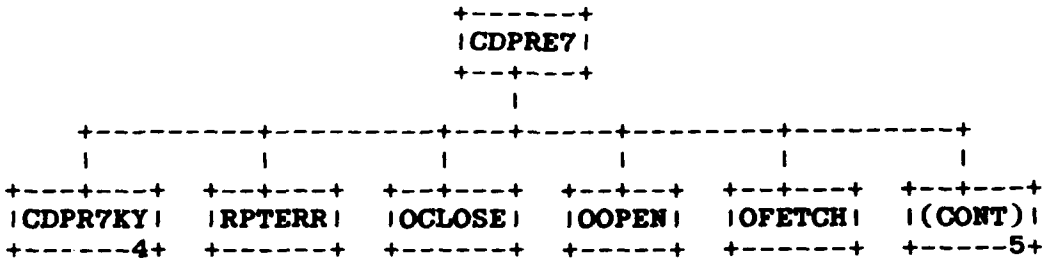
3.10.10 Hierarchy Chart

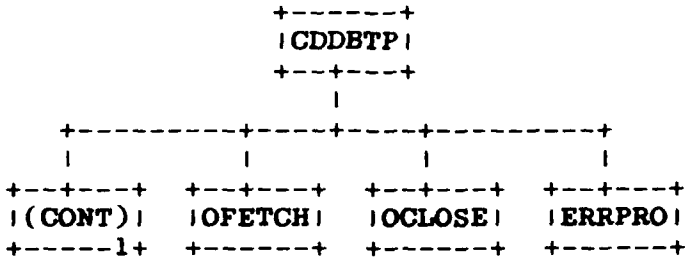
The following hierarchy charts show the relationships between all of the modules mentioned in the above documentation. A module may call a subroutine several times within its code, but the call will only be shown once as a single relationship on this hierarchy chart. All modules shown at the top of the first page are considered Main Programs as described in section 3.10.1 above.

There is an internal paging scheme as marked by the numbers in the upper right corner of each page. An index after the last page of the chart shows where a routine and its calls are first defined. If a routine has no page reference, it either makes no calls or is an external routine. A continuation box on the end of a tree limb shows where that the tree continues on the page numbered mentioned. A number in a box with a routine name points to the page where the routine is further defined within the hierarchy tree. If there is no number in a box, the routine either makes no calls or is an external routine.

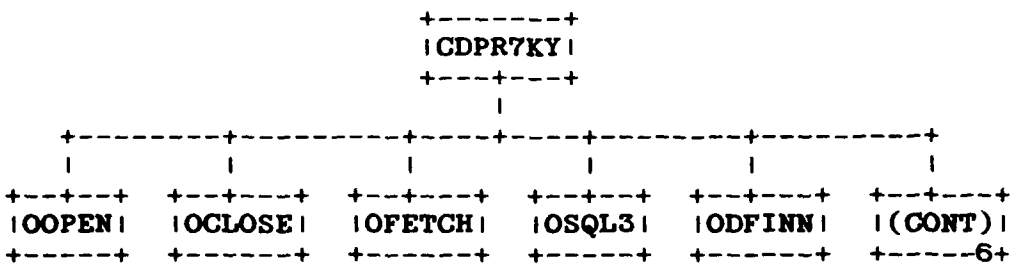
1

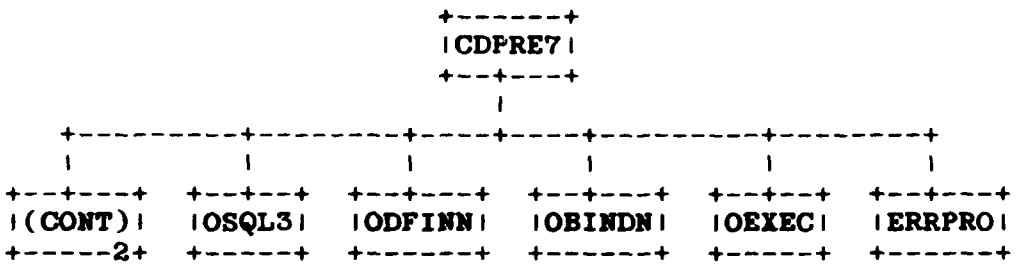



CDPRE7
CDPR7KY
4
RPTERR
OCLOSE
OOPEN
OFETCH
(CONT)
5

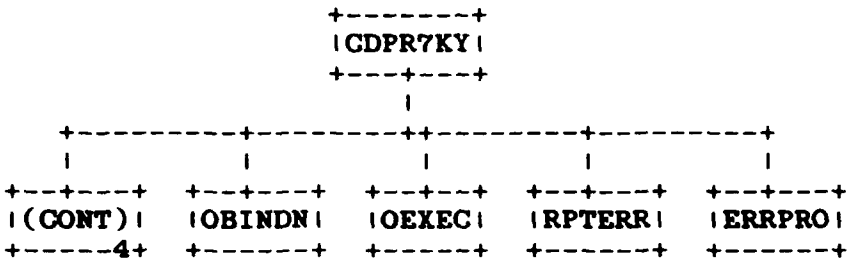

CDDBTP
(CONT)
OFETCH
OCLOSE
ERRPRO

4




CDPRE7
(CONT)
OSQL3
ODFINN
OBINDN
OEXEC
ERRPRO

6



3.11 Program Listings Comments

This information is contained in the Module Descriptions in section 3.10.

SECTION 4

QUALITY ASSURANCE PROVISIONS

4.1 Introduction and Definitions

"Testing" is a systematic process that may be preplanned and explicitly stated. Test techniques and procedures may be defined in advance, and a sequence of test steps may be specified. "Debugging" is the process of isolation and correction of the cause of an error

"Antibugging" is defined as the philosophy of writing programs in such a way as to make bugs less likely to occur and when they do occur, to make them more noticeable to the programmer and the user. In other words, as much error checking as is practical and possible in each routine should be performed.

4.2 Computer Programming Test and Evaluation

The quality assurance provisions for test consists of the normal testing techniques that are accomplished during the construction process. They consist of design and code walk-throughs, unit testing, and integration testing. These tests are performed by the design team. Structured design design walk-through and the incorporation of "antibugging" facilitate this testing by exposing and addressing problem areas before they become coded "bugs."


DAT
FILM